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H. H. ARMSTRONG

2,485,995

INNER COVER FOR HOOD-TYPE FURNACES

Filed Nov. 22, 1946

3 Sheets-Sheet 1

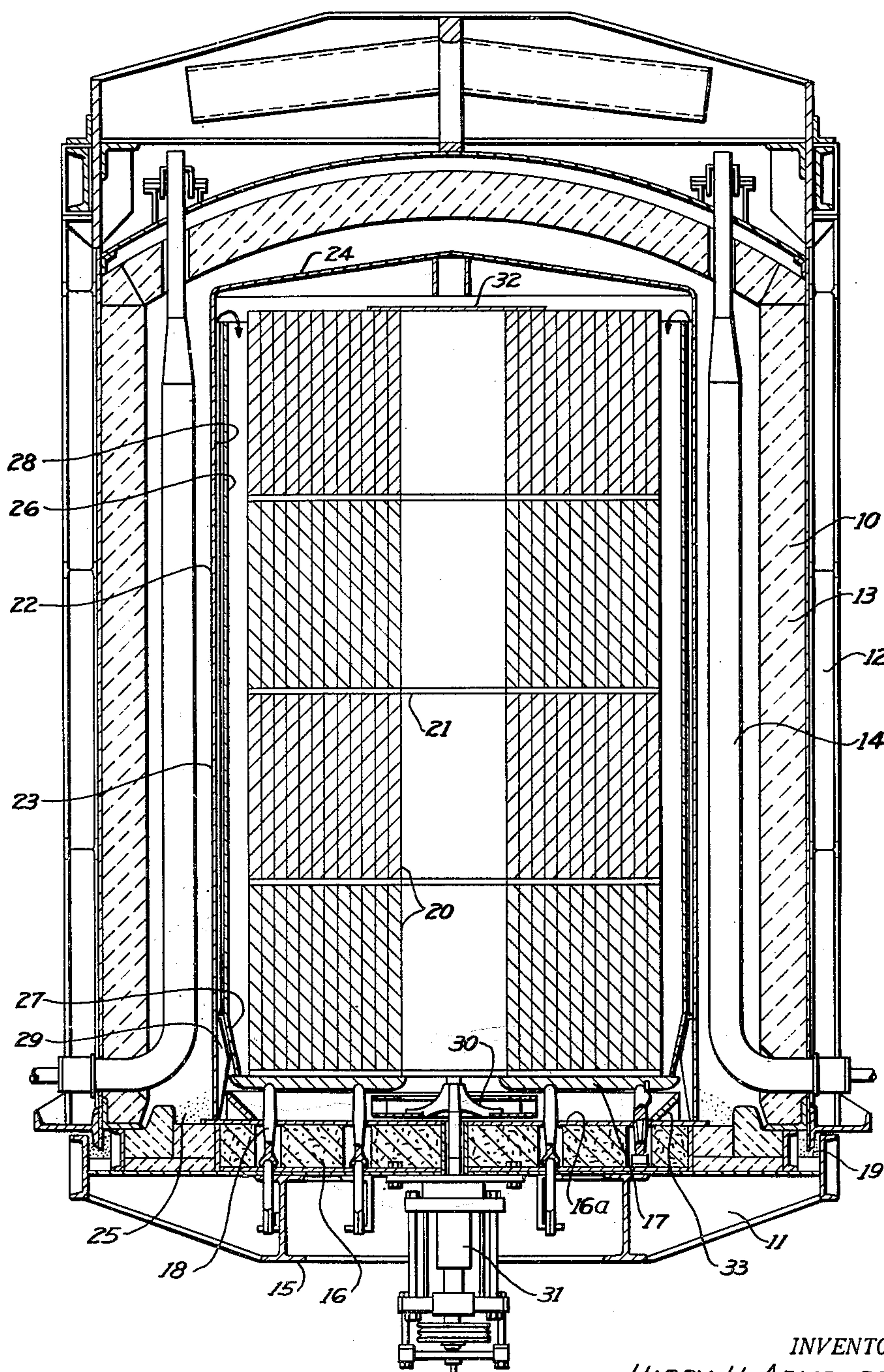


Fig. 1

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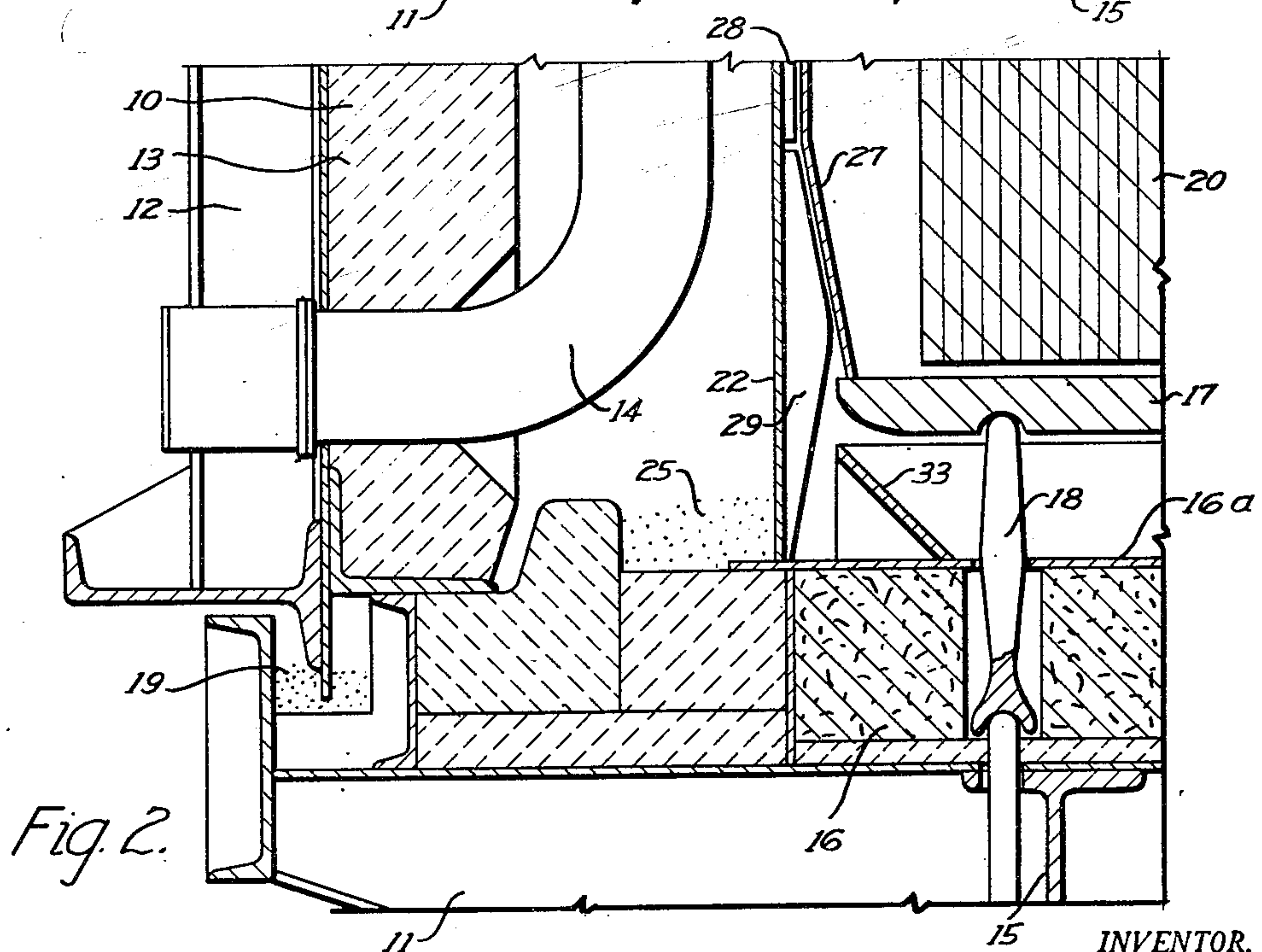
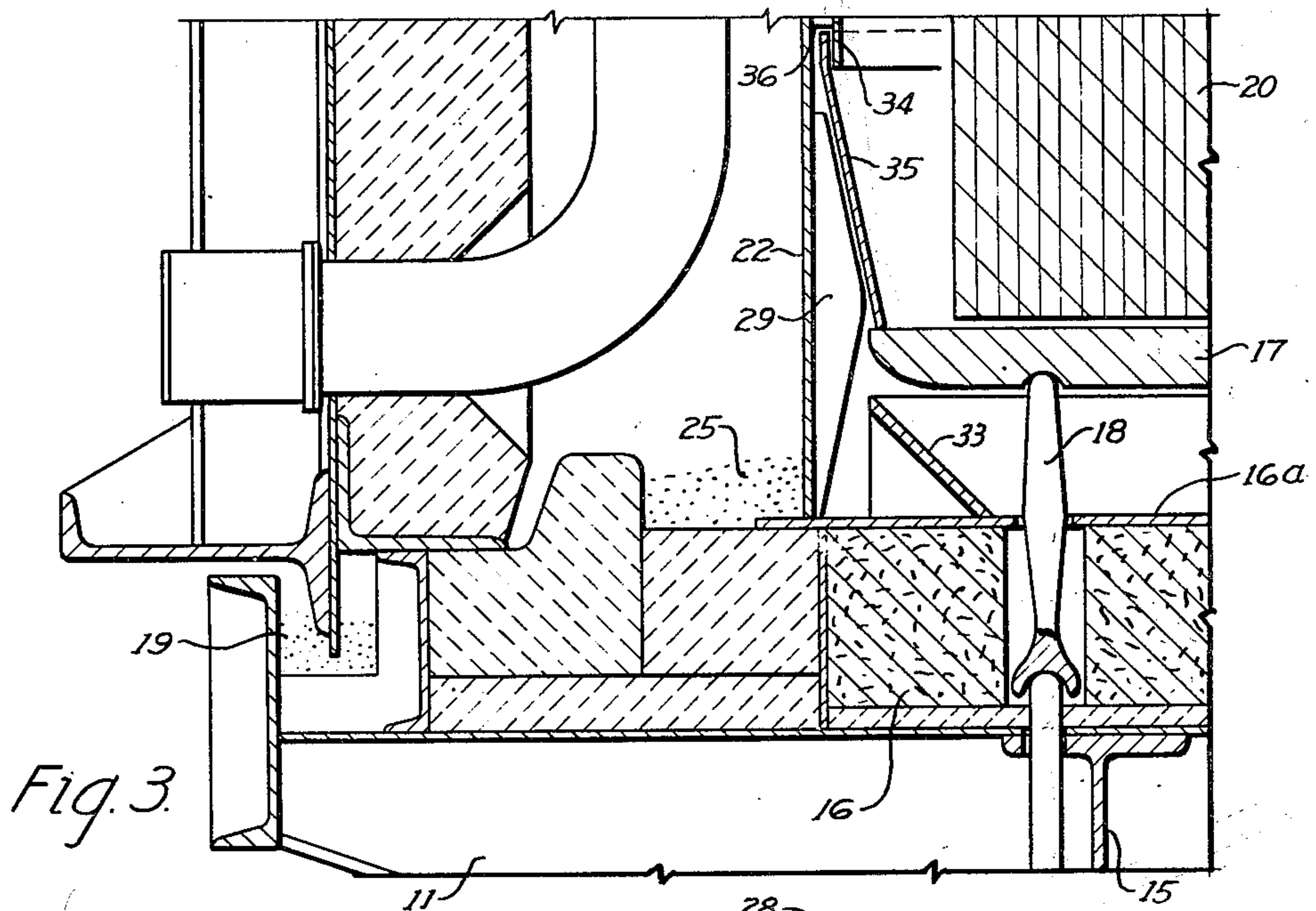
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3 Sheets-Sheet 2



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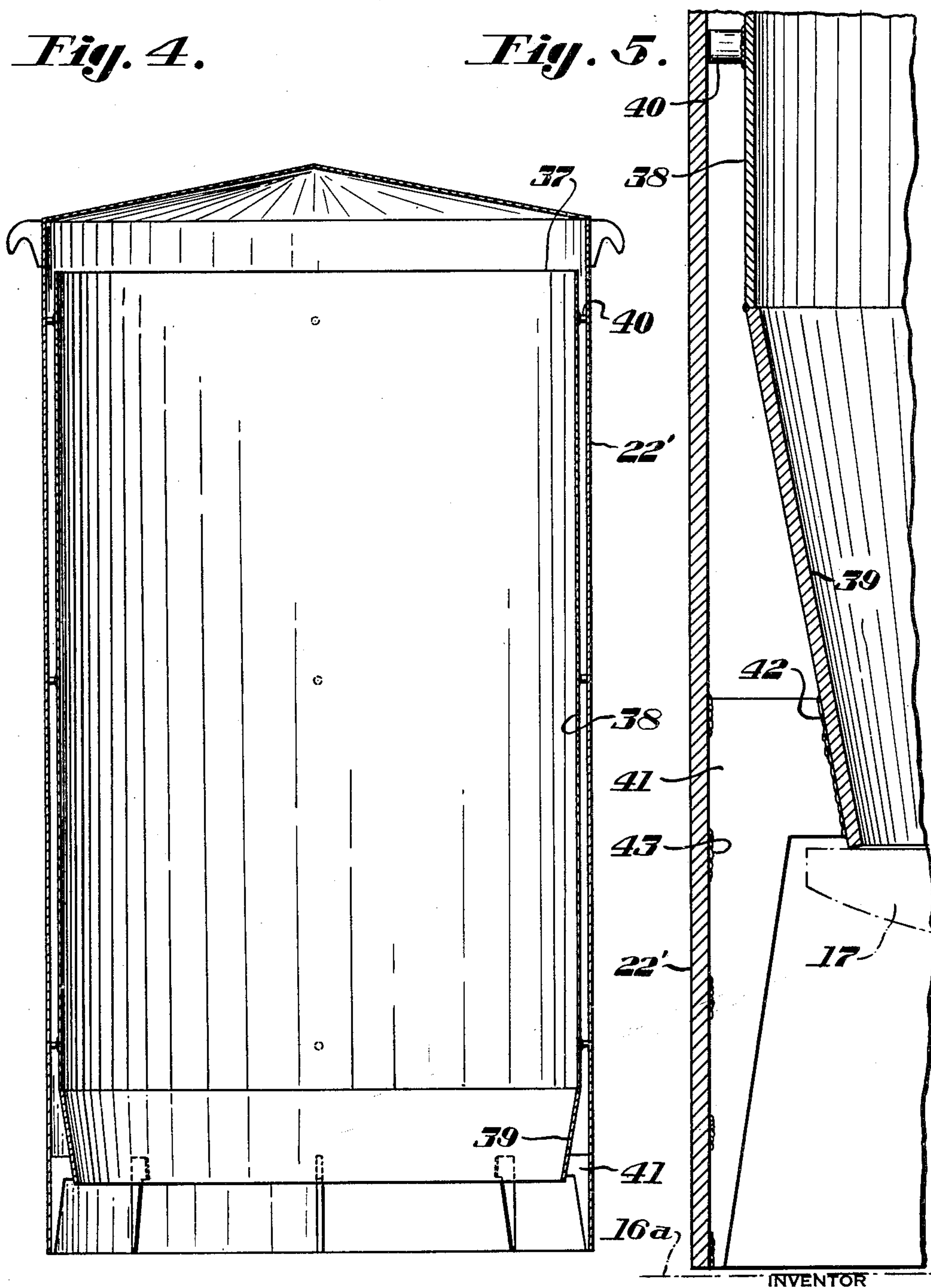
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Fig. 4.

Fig. 5.



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INNER COVER FOR HOOD-TYPE FURNACES

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Application November 22, 1946, Serial No. 711,784

3 Claims. (Cl. 263—43)

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This invention relates generally to annealing furnaces and, in particular, to an improved inner cover adapted to be used with a hood-type furnace for the annealing of a charge in the form of coils.

This is in part a continuation of my copending application, Serial No. 617,359, filed September 19, 1945, now abandoned.

Hood-type furnaces have come into extensive use for annealing in recent years. Such furnaces represent a marked advance over the earlier practice of heating a charge enclosed in an annealing box in a stationary furnace. A considerable period of time is still required, however, to raise the temperature of the charge to the desired point and, even though a single heating hood or furnace is usually placed over a plurality of bases in succession, the production of annealed material in tons per hour is such that the cost of annealing per ton is high. Various expedients have been tried in order to shorten the annealing cycle such as circulation of the atmosphere inside the inner or protective cover and in the case of annealing strip in coils, the use of spacers between the stacked coils forming the charge, to permit absorption of heat through the edges of the coil laps, i. e., axially instead of radially through successive thicknesses or laps.

I have invented an improved inner cover adapted to be used with conventional hood-type furnaces whereby the heating stage of the annealing cycle may be materially shortened so that a single heating hood may cooperate successively with a larger number of bases than has been possible heretofore, thus increasing the output of annealed material. In a preferred embodiment, the inner cover of my invention comprises a side wall and a top, being open at the bottom so it can be disposed over a charge. An inner wall or baffle extends around the cover spaced inwardly from the side wall and concentric therewith. The baffle insures intimate contact between the atmosphere within the cover, when circulated by the usual centrifugal fan in the base, and the inner surface of the side wall of the cover which is subjected to the heat from the hood. The atmosphere within the furnace is thus much more effective in transferring the heat from the wall of the cover to the charge than heretofore.

Further novel features and advantages of the

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invention will be explained during the following detailed description referring to the accompanying drawings illustrating a preferred embodiment. In the drawings,

5 Figure 1 is a central vertical section through a hood-type furnace and an inner cover incorporating the invention;

Figure 2 is a portion of Figure 1 to enlarged scale;

10 Figure 3 is a view similar to Figure 2 showing a modification;

Figure 4 is a vertical central section through a further modification; and

15 Figure 5 is a portion of Figure 4 to enlarged scale.

Referring now in detail to the drawings, a hood-type furnace of known construction comprises a hood proper shown at 10 removably disposed on a base 11. The hood includes a structural frame 12 and a refractory lining 13. Heating means of any desired type is mounted in the hood. In the example illustrated, radiant tubes 14 extend vertically within the hood and are heated by the combustion of fuel supplied at their lower ends.

20 The base 11 includes a structural frame 15 and a refractory lining or hearth 16 with a cover plate 16a thereon. A charge support 17 is carried at a suitable elevation above the hearth on posts 18 pivotally mounted on the structural frame 15 as more fully disclosed and claimed in my copending application, Serial No. 575,680, filed February 1, 1945, now Patent 2,414,996, issued January 28, 1947. The support 17 has a central opening therein. The base is provided with a sealing channel 19 adapted to be penetrated by a sealing flange carried by the hood.

30 A plurality of coils 20 stacked coaxially on the support 17 form the charge to be annealed. Spacers 21 are disposed between adjacent coils and between the bottom coil and the support. An inner cover 22 is disposed over the charge before the hood 10 is lowered onto the base. It is to this inner cover that my invention particularly relates. As shown in the drawings, the cover 22 comprises a side wall 23 and a top 24, thus forming an open-bottomed enclosure for the charge. The cover is preferably fabricated from plate of suitable thickness. The lower edge of the

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cover fits within a sealing channel 25 on the hearth or lining of the base.

The cover 22 has an inner wall or baffle 26 extending therearound terminating short of the top and bottom thereof and spaced inwardly of the side wall 22. The baffle 26 has a body which is the same shape in section as the inner cover, preferably cylindrical, for the greater portion of its height, but has a frusto-conical bottom ring 27 welded thereto which tapers downwardly. The baffle 26 fits loosely within the cover 22 and is maintained in substantially concentric relation therewith by ribs 28 secured as by welding to the inner surface of the side wall of the cover and spaced circumferentially thereof. This permits the cover and baffle to expand and contract independently of each other. Inwardly sloping ribs 29 are welded to the cover 22 adjacent the lower edge in circumferentially spaced relation and are adapted to engage the frusto-conical portion 27 of the baffle so as to lift it with the cover when the latter is raised as for removal of the charge after completion of the annealing.

The base 11 is provided with a centrifugal fan 30 mounted centrally thereof below the charge support 17. The fan is mounted on a shaft journaled in suitable bearing brackets 31 and is driven by any convenient means. It will be apparent that the fan when driven forces the atmosphere within the cover outwardly. Circulation of the atmosphere is thus established from below the charge support 17, upwardly through the space between the side wall of the inner cover and the baffle 26 and thence downwardly inside the latter, through the spaces between coils afforded by the spacers 21 and thence downwardly through the "eyes" of the coils and the central opening in the support 17 to the fan. A plate 32 is preferably disposed over the eye of the uppermost coiling stack to insure that the circulating atmosphere passes through the spacers before descending the flue formed by the eyes of the several coils.

By this mode of circulation, the atmosphere is brought repeatedly into intimate contact with the side wall of the inner cover which is subjected to the radiant heat from the tubes 14 and the rate of transfer of heat to the charge is thereby greatly accelerated. Both the inner cover and the heating hood are manipulated in the same manner as heretofore, being placed over the charge at the beginning of the heating stage and lifted therefrom, respectively, at the end of the heating stage and the cooling stage. As above pointed out, the baffle or inner wall of the cover, although fitting loosely within the latter, is automatically picked up and removed when the cover is lifted. When the inner cover is placed over the charge, the baffle or inner wall 26 bottoms on the support 17 just before the inner cover proper bottoms on the hearth or lining of the base.

In order to improve the circulation of atmosphere described above, I employ a frusto-conical ring 33 extending around the base within the inner cover.

In a modified form of my inner cover shown in Figure 3, the baffle or inner wall 26 comprises a cylindrical portion 34 and a frusto-conical portion 35 which is separate therefrom but coaxial therewith. The cylindrical portion 34 is welded to spacer ribs 36, thus the lower portion 35 is the only part of the baffle which is lifted by the ribs 29.

In a further modification shown in Figures 4

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and 5, the inner cover 22' has a baffle 37 spaced inwardly thereof similar to the baffle 26. The baffle includes a cylindrical body 38 and a frusto-conical bottom ring 39 welded thereto. Centering pins 40 are welded to the body 38 at spaced points around the exterior thereof. The baffle 37 fits loosely within the inner cover but is secured thereto at the bottom, being welded to web plates 41 as shown at 42. These plates are welded as at 43 to the interior of the cover. The bottom ring 39 is designed to engage the charge support 17 before the bottom of the cover 22a engages the hearth. Thus the cover is carried on the charge support by the bottom ring 39 and the bottom of the cover is free to expand and contract without restraint. This eliminates distortion of the cover which occurs when the bottom thereof engages the hearth more or less firmly, because of the difference between the coefficient of expansion of the brick of the hearth and that of the metal of the cover. The coefficients of expansion of the metal of the charge support and that of the cover are so close together that there is no distortion of the bottom ring 39 which carries the entire weight of the cover and baffle. The bottom of the cover thus serves only as a floating sealing skirt. Since the baffle is secured to the cover only at the bottom, it is free to expand or contract vertically at a rate different from that at which the cover expands or contracts.

It will be apparent from the foregoing that the invention is characterized by numerous advantages. In the first place, the inner wall or baffle of the inner cover produces a much more efficient heating of the charge by convection than was possible by inner covers known previously, because it insures intimate contact between the atmosphere within the inner cover which is the sole heat-transfer medium, and the side wall of the cover proper to which the heat is supplied. In the second place, the invention involves only a slight increase in the cost of the inner cover and no change in the operating procedure. The improved efficiency of heat transfer between the heating elements of the hood and the charge is reflected in a material reduction in the length of the heating stage of the annealing cycle. This permits a single hood to heat successively the charges on a larger number of bases than was heretofore possible, thus greatly increasing the output of annealed strip and reducing the cost of the annealing operation.

Although I have illustrated and described but a preferred embodiment of the invention, it will be recognized that changes in the construction disclosed may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. An inner cover for use within a hood-type furnace comprising a side wall, a top wall, a baffle wall spaced inwardly from said side wall and terminating short of the top and bottom of said side wall, said baffle wall including a frusto-conical lower portion tapering downwardly, and sloping ribs on said side wall adapted to engage said lower portion when said inner cover is raised.

2. An inner cover for use within a hood-type furnace comprising a side wall, a top wall, a baffle wall spaced inwardly from said side wall and terminating short of the top and bottom of said side wall, said baffle wall including a frusto-conical lower portion tapering downwardly, and

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sloping ribs on said side wall adapted to engage said lower portion when said inner cover is raised, said lower portion of said baffle wall being permanently united with the remainder of the baffle wall.

3. An inner cover for use within a hood-type furnace comprising a side wall, a top, a baffle wall spaced inwardly of said side wall and terminating short of the top and bottom of said side wall, said baffle wall fitting loosely within the inner cover, 10 and ribs spaced circumferentially of the inner surface of the side wall for maintaining the baffle wall generally concentric with the cover.

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